



## EQC

**Environmental  
Quality Commission**  
**Environmental  
Indicators Program**  
*Reporting on Environ-  
mental Trends and Con-  
ditions in Kentucky.*

1996-97 Reports

- Safe Drinking Water
- Air Quality
- Waste Management
- Toxics
- Water Quality
- Natural Resources
- Resource Extraction

EQC is a seven-member citizen commission created under state law with a mission to monitor environmental trends and conditions, promote partnerships to improve and protect the environment, provide a public forum for the discussion of environmental issues, and advise state officials on environmental matters.

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# 1996-97 State of Kentucky's Environment

## Resource Extraction

**T**he mineral resources of Kentucky contribute greatly to meeting the state's energy needs. For example, each day the average Kentuckian consumes 1.2 million Btu of energy at home, work, and at play—that's 22% more than the national average of 934,000 Btu. Kentucky ranks 8th in the nation in energy consumption per person.<sup>1</sup>

Kentucky's mineral resources also help to support the state and local economies. During 1995, the value of the coal, natural gas, petroleum, and other minerals mined in Kentucky was approximately \$4.4 billion.<sup>2</sup> The mining and quarrying industry employed 25,300 people that year, earning \$965 million in wages and income; a majority of which was attributed to the coal industry.<sup>3</sup>

But with this mineral and economic wealth comes environmental concerns. Resource extraction activities remain a major source of water pollution in Kentucky.<sup>4</sup> Efforts to address and minimize pollution impacts from coal mines and oil and gas operations continue. This *State of Kentucky's Environment Report* will review mineral production and energy consumption trends, enforcement and compliance issues at mine and drilling operations, and the status of abandoned sites.

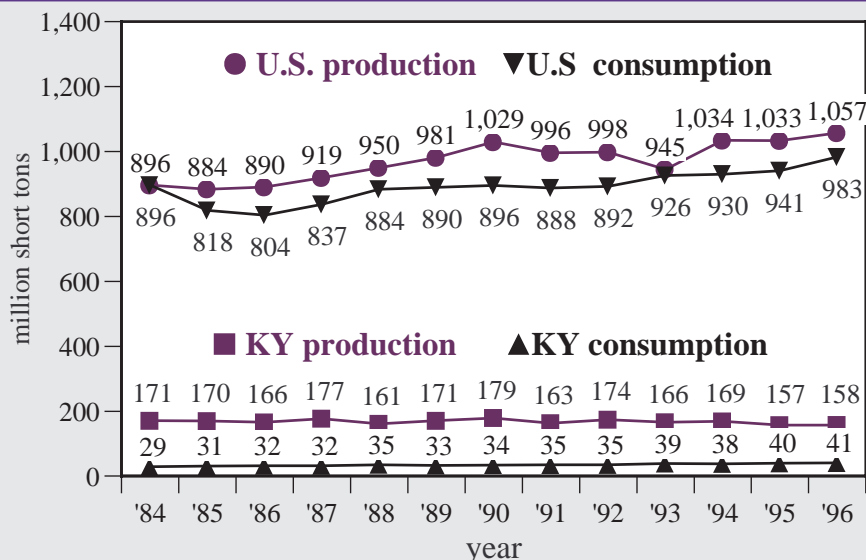
## Coal Mining

### Kentucky Ranks Third in Nation in Coal Production

U.S. coal production reached record levels in 1996 at 1,057 million short tons.<sup>5</sup> During 1996, Kentucky ranked third in the nation in coal production, supplying 15% of the nation's coal at 158 million tons (**Figure 1 & Figure 2**). More than 83% of Kentucky's coal is sold out-of-state.

Nearly 83% of the coal produced in the nation is consumed by power plants to

**Figure 1 Coal Production and Consumption in Kentucky and U.S.**



*Note: Does not include consumption by independent power producers. Source: KY Geological Survey, U.S. Energy Information Administration, KY Department of Mines and Minerals*

**Figure 2 Top 10 Coal Producing States**

1,000 short tons			
State	1995	1996	%*
WY	264	278	+5.3
West Va.	163	166	+2.6
<b>KY</b>	<b>157</b>	<b>158</b>	<b>+0.6</b>
Penn.	62	68	+9.6
Texas	53	55	+5.0
Illinois	48	46	-4.5
Montana	39	38	-3.9
Virginia	34	36	+4.7
N. Dakota	30	30	+0.2
Indiana	26	30	+15
<b>top 10</b>	<b>873</b>	<b>972</b>	<b>+2.7</b>
<b>U.S.</b>	<b>1,033</b>	<b>1,057</b>	<b>+2.3</b>

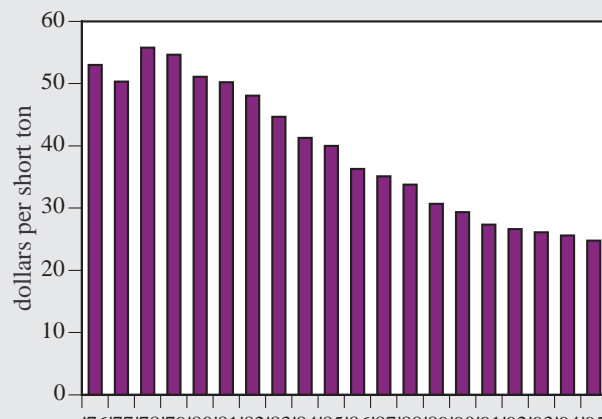
\*Percent change 1995-96.  
Totals rounded. Source: U.S. Energy Information Adm.

**Figure 4 Average Price for Coal Delivered to Electric Utilities - Top Ten Coal Producing States (1996)**

State	Average price
Wyoming	\$14.33
W. Va.	\$30.94
<b>Kentucky</b>	<b>\$24.43</b>
Penn.	\$34.07
Texas	\$19.27
Illinois	\$32.17
Montana	\$11.90
Virginia	\$35.73
N. Dakota	\$9.72
Indiana	\$24.67
<b>U.S. average</b>	<b>\$26.45</b>

Source: U.S. Energy Information Administration

*The coal reserves in several principal beds in Kentucky may be significantly diminished in the near future. The resources that remain are more likely to be thinner, of poorer quality, and more challenging in terms of mining conditions.*<sup>13</sup>

**Figure 3 Average Price for Kentucky Coal Delivered to Electric Utilities**

Note: Adjusted for inflation using the consumer price index for 1995. Source: U.S. Energy Information Adm.

was \$24.43 per short ton (Figure 3 & Figure 4).

Increasing competition from western states, where the coal is easier to mine and more plentiful, will continue to present significant economic challenges to Kentucky coal, according to state experts.<sup>8</sup> This added competition has further depressed Kentucky coal prices and resulted in lower profit margins. However, many predict that Kentucky coal will continue to compete in the marketplace due to its high heat content. The average heat content of Kentucky coal is 12,200 Btu per pound compared to 8,650 Btu per pound for Wyoming coal.<sup>9</sup>

## 7.4 Billion Tons of Coal Mined In Kentucky; Some Experts Predict 20 to 30 Years of Recoverable Reserves Remain

Coal is found in two regions of the state; the Eastern Kentucky Coalfield and the Western Kentucky Coalfield. More than 7.4 billion tons of coal has been mined in these coalfields during the past 200 years—about half this amount being extracted within the past 25 years.<sup>10</sup>

An estimated 32.5 billion tons in demonstrated coal reserves remain in the state (Figure 5). But a 1993 study of the coal resource of Eastern Kentucky indicates about half of the reserves are not recoverable given current technology, land use restrictions, and other factors.<sup>11</sup> Of the 12.86 billion tons of demonstrated reserves in Eastern Kentucky, only 7.1 billion tons are recoverable.

Officials with the Kentucky Geological Survey predict that recoverable coal reserves in Kentucky will significantly decline in the next two to three decades. Kentucky Coal Association officials, however, indicate that other factors, such as national demand, new technologies, and expanded markets for coal, such as specialty steel and chemical markets, will determine how much coal is mined in Kentucky.<sup>12</sup> It is certain, however, that the coal reserves in several principal beds in Kentucky may be significantly diminished in the near future. The resources that remain are more likely to be thinner, of poorer quality and more challenging in terms of mining conditions.<sup>13</sup>

**Figure 5 Coal Reserve Base-Top 10 Coal Producing States (1995)**

State	billion tons
Wyoming	68.495
W. Va.	35.983
<b>Kentucky</b>	<b>32.564</b>
Penn.	28.867
Texas	13.064
Illinois	89.956
Montana	119.773
Virginia	2.327
N. Dakota	9.470
Indiana	9.990
<b>top 10</b>	<b>410.489</b>
<b>Total U.S.</b>	<b>495.665</b>

Note: Demonstrated reserve base. Includes anthracite, bituminous, subbituminous, lignite coal. Source: U.S. Energy Information Administration

## 74% of Coal Mined in East Kentucky, Pike County Leads in Production

In 1996, 74% of the coal extracted in the state was mined in the Eastern Kentucky Coalfield (**Figure 6**). This coalfield contains 40 mineable beds and covers more than 10,400 square miles.<sup>14</sup> The average heat content of the coal is about 13,000 Btu per pound with a sulfur content of 1% to 2%.<sup>15</sup>

In the Western Kentucky Coalfield there are less than 20 mineable coalbeds. The heat content is slightly lower than in the eastern field and the sulfur content is higher at about 3% to 4%.<sup>16</sup> Because of the differences in coal quantity and quality, the Eastern Kentucky Coalfield has become the state's primary source of coal production.

In 1996, seven counties (Pike, Webster, Martin, Harlan, Perry, Hopkins, Leslie) accounted for 63% of the coal mined—100.1 million short tons (**Figure 7**). Pike County remains the leading coal producer in the state with 35.3 million tons mined in 1996; a quarter of the coal output in the state.

## Underground Mines Account for 63% of Coal Produced in 1996

Underground mines have become the principal method used in Kentucky to extract coal. Nearly 63% of the coal mined in Kentucky during 1996 was from underground mines (**Figure 8**).

Between 1987 and 1996 surface mine production in the Western Kentucky Coalfield declined 44% while underground production increased 56% (**Figure 9**). This trend may be due to diminished surface-minable reserves in the region.<sup>17</sup>

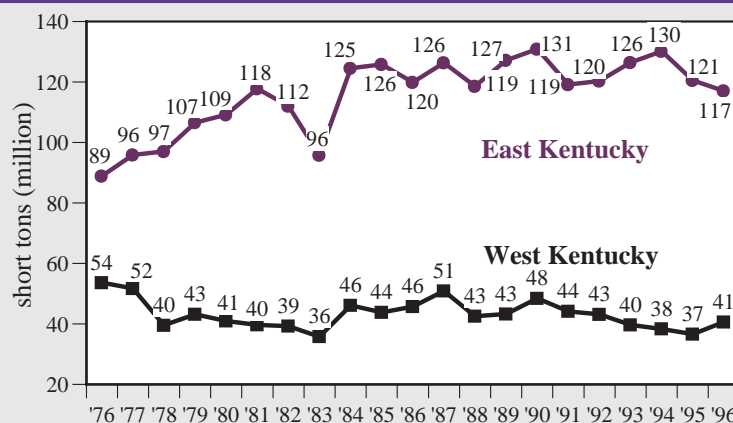
In the Eastern Kentucky Coalfield, significant surface mine production did not occur until the 1970s triggered by new developments in contour surface mine technology and high demand for coal as a result of the OPEC oil embargo.<sup>18</sup> Surface mining production began to decline in the region as high quality surface reserves diminished and regulatory costs increased after the passage in 1977 federal Surface Mine Control and Reclamation Act. Between 1978 and 1995, trends reveal that surface mining had declined 12% in the Eastern Kentucky Coalfield, while underground mining increased 62% (**Figure 9**).

## Kentucky Mines Continue to Decline, Production Per Mine Increases

Kentucky has the largest number of mines in the U.S. with 544 active operations in 1996 compared to West Virginia's 386 and Wyoming's 27.

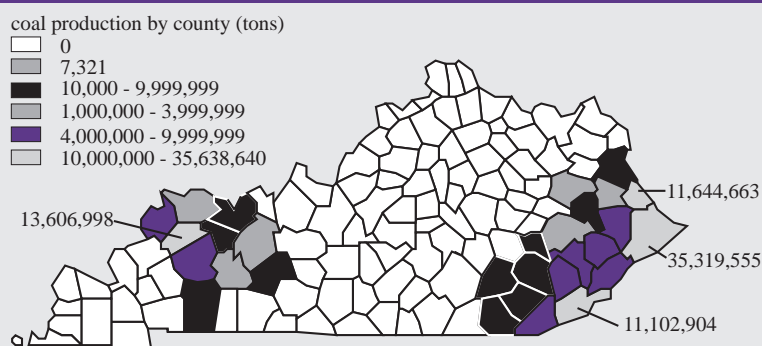
**Figure 10** shows that the number of Kentucky mines fell from 1,858 in 1985 to 544 in 1996. The drop is attributed to several factors including the repeal of the state's two-acre mine exemption in 1987 and a shift from small independent coal companies to large diversified firms. Many small firms left the industry or merged as coal prices fell and companies could not recover their costs. In recent years the number of mines continue to decline due to the consolidation of operations into

**Figure 6 Regional Coal Production in Kentucky**



Source: KY Department of Mines and Minerals

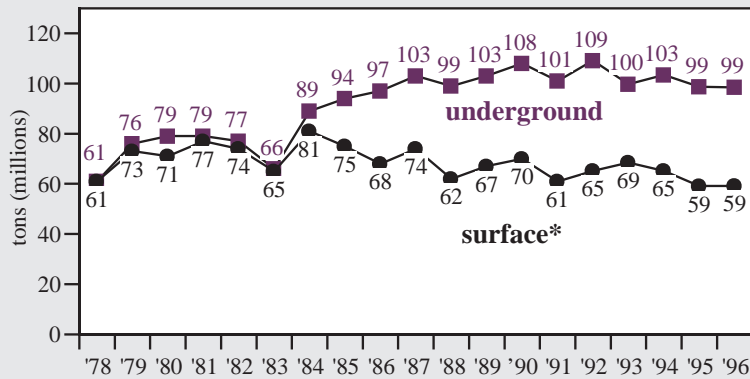
**Figure 7 Coal Production by County (1996)**



Source: KY Department of Mines and Minerals

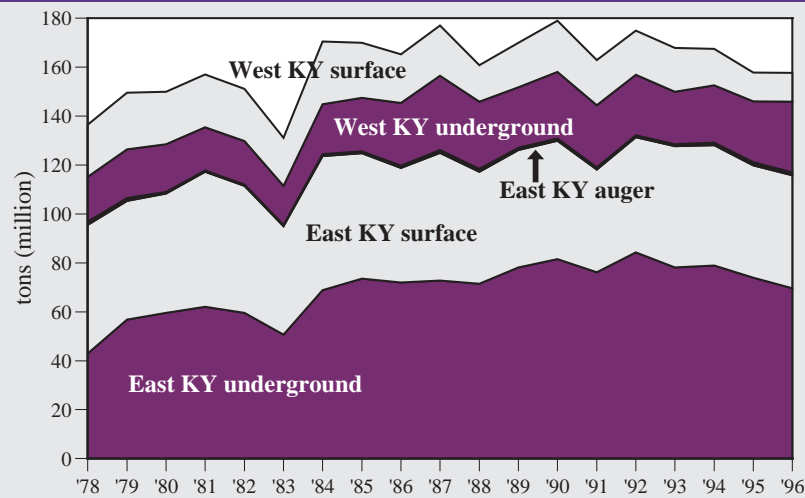
*In 1996, seven Kentucky counties (Pike, Webster, Martin, Harlan, Perry, Hopkins, Leslie) accounted for 63% of the coal mined—100.1 million short tons.*

*Kentucky has the largest number of mines in the U.S. with 544 active operations in 1996, compared to West Virginia's 386 and Wyoming's 27.*

**Figure 8 Coal Mining Methods in Kentucky**

\*Includes strip, auger, and auger/strip.

Source: KY Department of Mines and Minerals

**Figure 9 Coal Mining Methods by Region in Kentucky**

Note: Surface mining is primarily the use of mountain top and contour mining in East Kentucky and area mining in West Kentucky. Underground mining is primarily the use of room and pillar, long wall, and drift mining techniques. Auger mining is used in East Kentucky and extracts coal from underneath the remaining mountain or hill top. Source: KY Department of Mines and Minerals

Since the mid 1980s, underground mines have become the principal method used in Kentucky to extract coal. Nearly 63% of the coal mined in Kentucky during 1996 was from underground mines.

of mining to the environment.

Kentucky obtained federal authority to carry out the provisions of the SMCRA in 1982. Since then, the Kentucky Department of Surface Mining Reclamation and Enforcement (DSMRE) has been the primary regulatory authority while the U.S. Office of Surface Mining (OSM) has maintained an oversight role to ensure compliance with the federal law. The role of OSM has come under fire by coal industry and state officials in recent years claiming the enforcement authority of the agency is duplicative. Last year the OSM budget was cut by \$24 million—from \$316 million in 1995 to \$292 million in 1996, resulting in layoffs of 164 of its 894 employees. An additional 83 vacant positions were also eliminated. In the Kentucky OSM field office staff fell 37%, from 54 people in 1995 to 34 in 1997. The reductions in the Kentucky office primarily targeted administrative positions. However, the agency did lose five of its 19 field inspectors.

Coal mining activities are required to be permitted by DSMRE before operations can begin. The permit process specifies operation and reclamation requirements for a mine site. The permit process has become increasingly complex over

larger mining operations. In 1996, the average permitted surface mine was 343 acres and the average permitted underground mine was 900 acres.<sup>19</sup>

While the number of mines have declined in the past 10 years, coal production has remained stable. This is attributed to increased efficiency in the extraction of coal brought about by larger, more productive mining machinery and a greater emphasis on productivity. Coal production per mine has more than tripled since 1985 and now averages 279,000 short tons per year (Figure 10).

A closer look at coal production in 1996 reveals that nearly 64% of the state's coal production came from 31 mines which produced an average of 1.7 million tons per year. The state's largest mine, Arch of Kentucky Number 37 in Harlan County, produced 4.5 million short tons in 1996 (Figure 11). As mines have become more mechanized employment has fallen 38% in the past nine years, from 31,503 employees in 1988 to 19,372 in 1996.<sup>20</sup>

### 1,157 Underground, 1,144 Surface Mine Permits Active in 1997

The environmental impacts of coal mining have been regulated to some degree in Kentucky since 1966. But it was not until the passage of the 1977 federal Surface Mining Control and Reclamation Act (SMCRA) that the state began to more fully address the impacts

the past two decades. For example, operations must now collect baseline environmental data and conduct groundwater modeling and, in some cases, archeological studies. While permit costs and timeframes vary based on the type of facility, some average costs are as follows.<sup>21</sup> The average time to get an underground coal mining permit (1,000-acre room and pillar) in Kentucky is 6-8 months at an average cost of \$25,000. For a 500-acre surface operation the permit time ranges from 10-12 months at a cost of \$40,000. A coal preparation plant permit of 100 acres with 25 houses takes 10-12 months to receive and costs \$30,000 while a coal refuse disposal and slurry impoundment permit of 150 acres costs \$250,000 and takes 1-2 years to permit due to the design requirements as specified under state and federal law to protect public safety and the environment. Recent state efforts have focused on improving the efficiency of the permitting program through the electronic submittal of applications to DSMRE. The first priority of the Electronic Permitting Initiative is to develop electronic transmission of water quality data.

As of June 30, 1997, Kentucky had 2,931 active or temporarily inactive coal mine permits on private and federal land as follows:

- 1,157 surface mine permits.
- 1,144 underground mine permits.
- 630 other facilities.

### 1.56 Million Acres Permitted for Coal Mines Since 1978

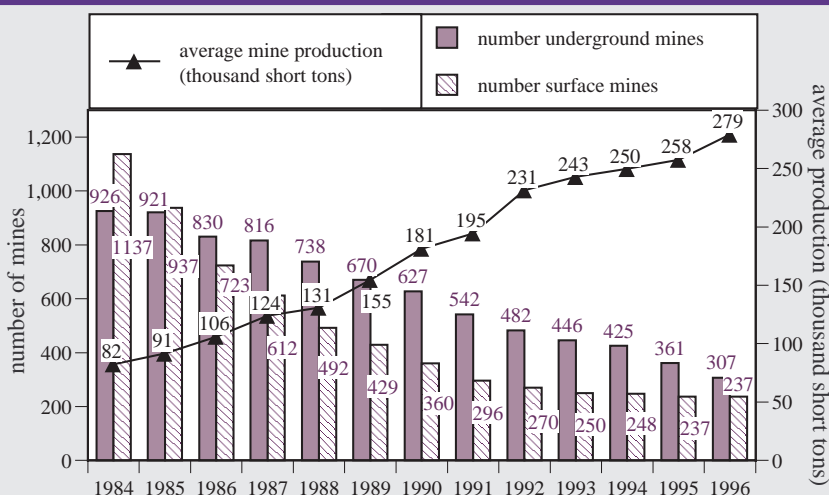
Between 1978 and 1996, 1.56 million acres, about 6% of the state's 25.8 million acres of land, have been permitted for coal mining. It should be noted that not all surface acreage permitted for coal mines is actually disturbed. For example, acreage overlaying underground mines must be included in permits. Most underground mines actually disturb very little surface acreage.<sup>22</sup> Unfortunately, historical data is not available to determine the total acreage of land actually disturbed by coal mining.

Data, however, is available beginning in 1989 on yearly acreage disturbed by coal mines (**Figure 12**). In 1996, 273,000 acres of land were disturbed by coal mining (being mined or in some stage of reclamation). A majority of this acreage, 76%, was in Eastern Kentucky. Yearly acreage permitted for coal mining during the past six years averaged 63,000 acres per year (**Figure 12**).

### Half Million Acres of Mine Land Fully Reclaimed Since 1984

Since 1984, 544,000 acres of permitted mine lands have been reclaimed in Kentucky (**Figure 13**). While data are not available to determine post-mine reclamation land use, DSMRE reports that most mine lands are reclaimed to hay and pastureland.

**Figure 10 Number of Coal Mines, Average Production in KY**



Source: U.S. Energy Information Administration

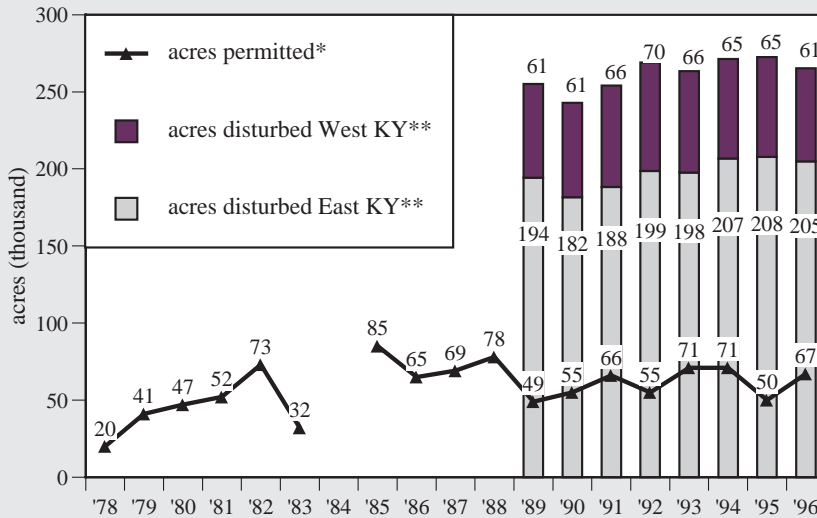
**Figure 11 Top 10 Producing Mines in Kentucky (1996)**

Company/ (County)	mine	million tons
Arch of KY (Harlan)	#37	4.5
Costain Coal (Webster)	#13	4.0
Martiki Coal (Martin)	#11598	3.1
Peabody Coal (Union)	Camp #11	3.1
Star Fire (Knott)	Knott City*	3.0
Elk River (Leslie)	#18	2.9
Peabody Coal (Union)	Camp #1	2.9
Webster Coal (Webster)	Dotiki mine	2.7
Leexo Inc. (Perry)	#63	1.5
Solid Energy (Pike)	#1	1.4
<b>Total top 10</b>		<b>29.2</b>

\*Mine number 11040, 16299, and 16876.

Source: U.S. Energy Information Adm.

Nearly 64% of the state's coal production in 1996 came from 31 mines which produced an average of 1.7 million tons of coal per year.

**Figure 12 Coal Mine Acres Permitted and Disturbance in Kentucky**

\*Acres only reflect those permitted acres actually disturbed through original applications issued during those calendar years. Does not include acreage added under permit revisions or amendments. 1984 acreage not shown (517,000 acres repermited in 1984 as a result of transition from interim to permanent program which also includes acreage permitted for the first time that overlays underground mine workings). \*\*Acreage disturbed by permitted mines either actively mining or in some stage of reclamation as of December 30 for each year provided. Earlier data not available. Source: KY Dept. of Surface Mining

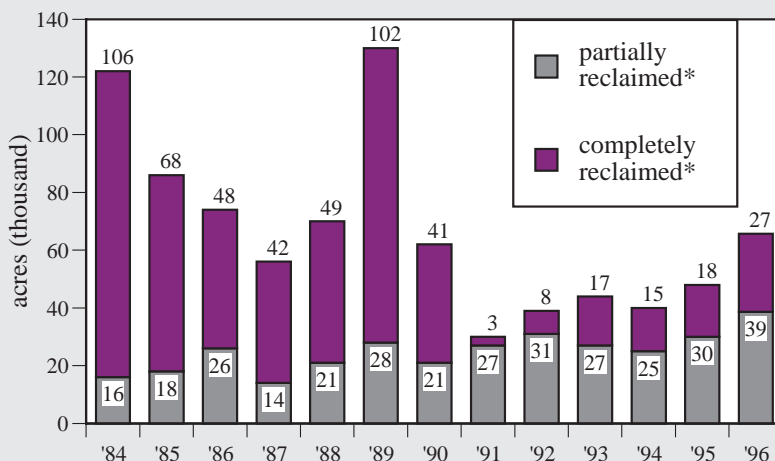
About 6% of the state's 25.8 million acres of land has been permitted for coal mining. In 1996, 273,000 acres were disturbed (being mined or in some stage of reclamation). A majority of this acreage, 76%, was in Eastern Kentucky.

Resources and Environmental Protection Cabinet established a work group to review current reclamation practices that impact tree survival and develop guidance that would promote trees on mined lands. On March 10, 1997, DSMRE issued a Reclamation Advisory Memorandum (RAM) #124 to promote reforestation of mine lands which includes:

- Selection methods for growth medium to encourage tree root development.
- Avoidance of soil compaction by leveling in separate operations.
- Procedures for compatible ground cover to avoid competition with seedlings.
- Fertilization requirements based on soil tests and tree species.
- Tree species based on approved post mining land use and site characteristics.
- Proper tree planting procedures.

DSMRE has conducted eight outreach and training reforestation sessions with

the coal industry, field inspectors, and permitting personnel. Additional training sessions are being scheduled. It is anticipated that promoting forests as a post mining land use will become a standard practice for DSMRE.

**Figure 13 Coal Mine Acres Reclaimed in Kentucky**

\*Based on partial or full coal mine bond releases.

Source: KY Department of Surface Mining Reclamation and Enforcement

### 76% of Coal Mine Operations in Compliance with Permits

Trends indicate that compliance with coal mining rules in Kentucky has improved over the past 10 years based on a general assessment conducted by OSM as seen in Figure 14.

The compliance rating is based on random oversight inspections conducted by OSM. The number of over-

sight inspections have varied in recent years from 430 in 1994, 273 in 1995, 158 inspections in 1996, and 374 in 1997. Due to changes in oversight inspections procedures, the compliance data for 1996 was not included in **Figure 14**.

### Sediment Control Leading Coal Mining Citation, 13% of Permits Had One or More Citations

A review of coal mine violations reveals that sediment control leads as the most frequently cited performance standard violation at coal mines in Kentucky (**Figure 15**). Sediment control violations pertain to the construction and maintenance of sediment ponds and silt fences. Off-site disturbances ranked second in the number of violations. A review by OSM of 178 off-site violations found that about half impacted surface water impairing 33.4 miles of streams.

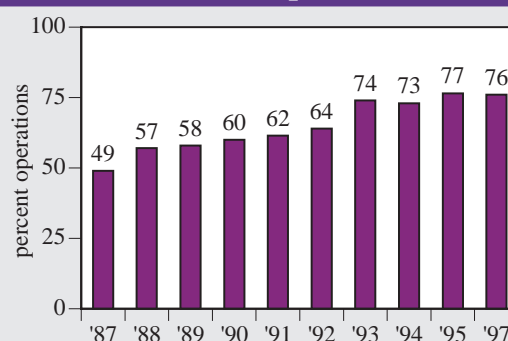
The agency also found off-site impacts to ten wells and 146 acres of land.<sup>23</sup> Backfilling and grading was the third most cited violation and includes erosion, highwall settlement, slumpage, and improper material placement. OSM found that in 1995, 89% of the violations were on-the-ground as opposed to paperwork violations.<sup>24</sup>

**Figure 16** reveals that the number of citations cited by DSMRE dropped by 24%, from 2,356 in 1995 to 1,801 in 1996. During 1996, about 13% of the active coal mine permits had one or more citations of coal mining performance standards. This continued drop in citations is attributed to a decline in permits, improved compliance of operators, and a stronger state emphasis on preventative enforcement. DSMRE primarily attributes the increase in violations in 1994 to wet weather conditions.

Penalties assessed against violators show declining trends as well (**Figure 17**). Many fines cannot be collected due to bankruptcies or a lack of company assets. The penalties collected have remained fairly constant during the past several years (**Figure 17**). In fiscal year 1997, \$1.5 million in coal mine penalties were collected. Currently, about \$6.3 million in outstanding penalties await collection.

The state is required by law to conduct eight partial and four complete inspections on each active coal mine permit per year. **Figure 18** indicates that inspections have been decreasing since

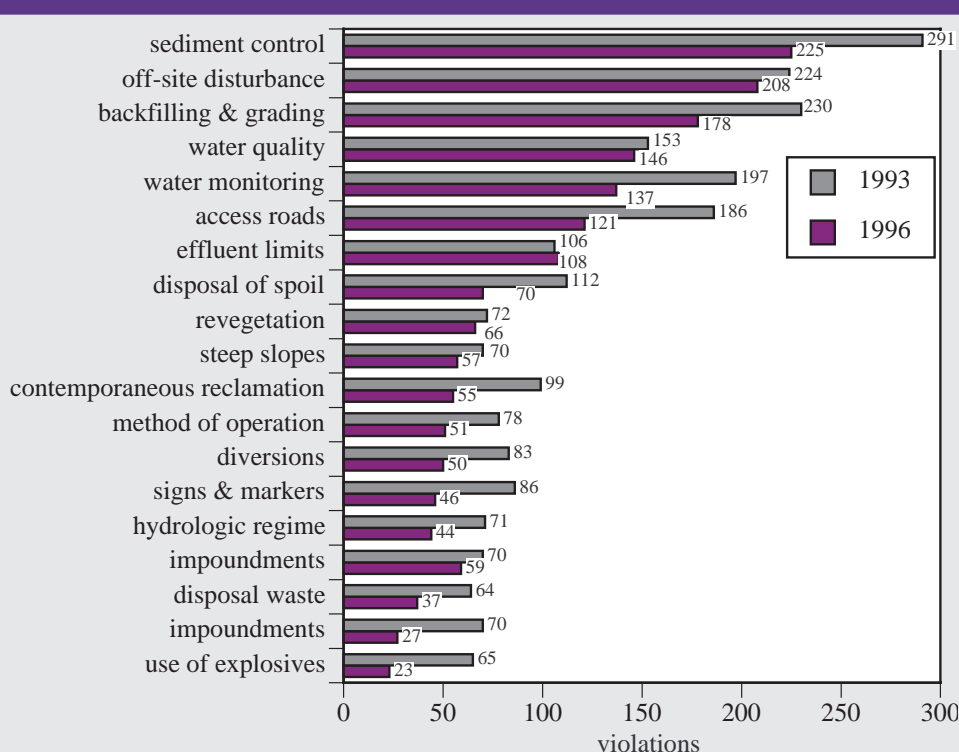
**Figure 14 Compliance of Kentucky Coal Mine Operations**



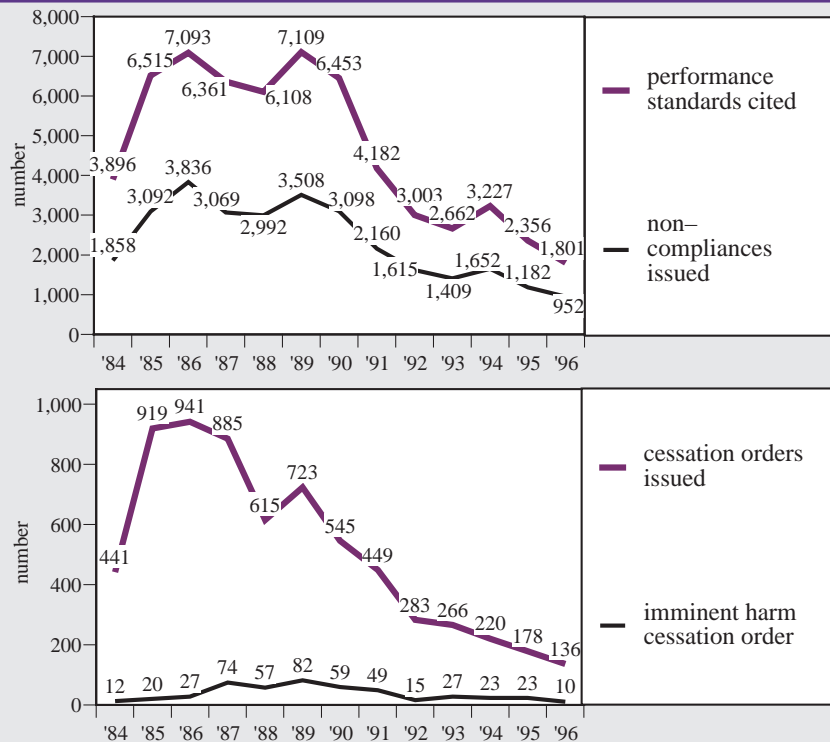
Note: Based on random oversight inspections conducted by the federal Office of Surface Mining. 1996 data not included due to changes in inspection procedures. Source: U.S. Office of Surface Mining Annual Evaluation Reports

*Trends indicate that compliance with coal mining rules in Kentucky has improved over the past 10 years. Sediment control leads as the most frequently cited violation at coal mines in Kentucky.*

**Figure 15 Most Frequently Cited Coal Mine Violations in KY**



Note: Based on leading violations of performance standards established to protect the environment. Source: KY Department of Surface Mining Reclamation and Enforcement

**Figure 16 Coal Mining Enforcement: Violations in KY**

*Note: Performance standards - specific standards that must be met according to state and federal rules. Noncompliance - documents violations, remedial measures, and schedules for completion of actions. Cessation order - requires operator to cease operations for failure to abate violation and until violation is corrected. Imminent harm cessation order - requires operator to cease operations due to imminent harm or potential danger to the public and environment.*

*Source: KY Dept. of Surface Mining Reclamation and Enforcement*

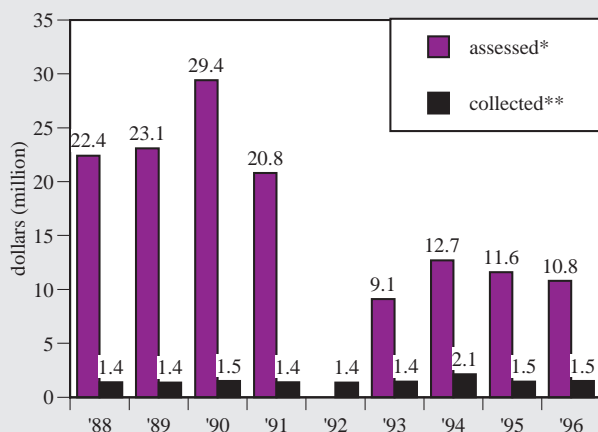
1986. This is primarily due to the decline in the number of mines and a shift from active to inactive mine sites due to the completion of mining and reclamation. OSM reported in 1997 that DSMRE had a good record in regard to mine inspections—inspecting 99% of the permits as required by law.<sup>25</sup>

### 391 Water Violations Cited at Mine Sites in 1996

Coal mines are contributing to water pollution in Kentucky, according to the 1996 Kentucky Report to Congress on Water Quality. Active, inactive, and abandoned coal mines were responsible for impairing 963 miles of waterways, about 31% of the 3,119 miles of assessed waterways with major impacts.

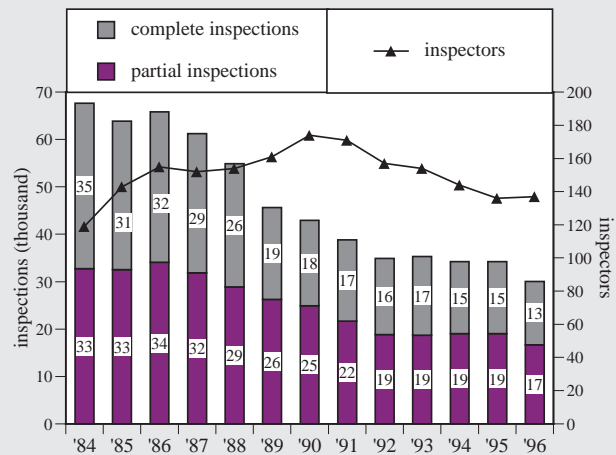
Siltation from coal mines can impair water quality and destroy aquatic habitat. Siltation is the second leading cause of water pollution in Kentucky. Contaminated runoff from mines is also contributing to acidity and elevated levels of toxic metals found in some monitored

streams. Information is not available to determine how much of this pollution is caused by active mines versus abandoned mines. However, data does reveal that acid mine drainage is responsible for about 34% of the 963 miles of assessed streams

**Figure 17 Coal Mine Enforcement: Penalties Assessed and Collected in KY**

*\*1992 data not available due to computer problems. \*\*Collections may include assessments from any given year since the inception of the state surface mining program.*

*Source: NREPC, Office of Administrative Hearings*

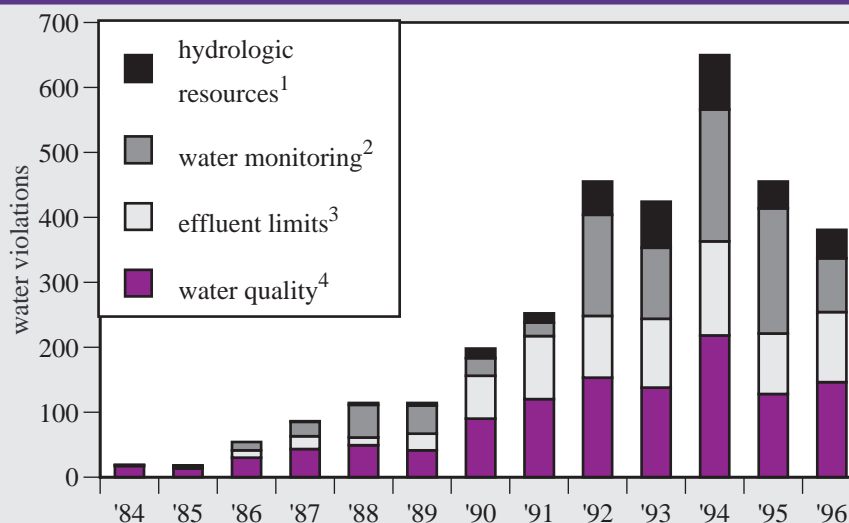
**Figure 18 Coal Mining Enforcement: State Inspectors and Mine Inspections**

*Note: Includes 8 partial and 4 complete inspections per active coal mine permit each year. Data also include inspections of inactive and abandoned mines. Source: KY Dept. of Surface Mining Reclamation and Enforcement*

and rivers impaired by coal mining in Kentucky. Acid mine drainage is primarily associated with abandoned coal mines. Abandoned minelands may also be contributing to sedimentation problems found in a number of waterways.

A review of the 1,801 violations cited in 1996 at active coal mines in Kentucky reveals that 381, or 22%, were water-related. **Figure 19** shows that since 1984, water-related violations cited at mine sites have increased. DSMRE officials indicate that the increase in water violations is due to better enforcement and improved water sampling methods. They note that the high number of water violations cited in 1994 was likely due to wet weather which contributed to runoff and other water control problems at mine sites.

**Figure 19 Coal Mine Water Violations in Kentucky by Type**



1. Hydrologic resources - violations concerning drainage, discharge, or anything which may contaminate the water systems associated with the permitted area. 2. Water monitoring - violations concerning sampling and analyses of surface and groundwater associated with and affected by a permitted area. 3. Effluent limits - violations concerning substandard discharges which are required to be reported under KPDES water discharge permits. 4. Water quality - violations concerning substandard discharges and discharges which have not passed through an approved sediment control facility. Source: KY Dept. of Surface Mining Reclamation and Enforcement

### 952 Coal Mine Complaints Received in 1996; 5% Result in Violations

In 1996, 952 citizen complaints concerning coal operations were received by state officials; the second lowest number recorded since 1984 (**Figure 20**). Most complaints concern coal mine blasting. Kentucky leads the nation in the use of explosives (**Figure 21**). In 1996, 2.4 million metric tons of explosives were sold in the U.S.—356,000 tons of which were sold in Kentucky.<sup>26</sup> Coal mining accounts for about two-thirds of total U.S. explosive sales.<sup>27</sup>

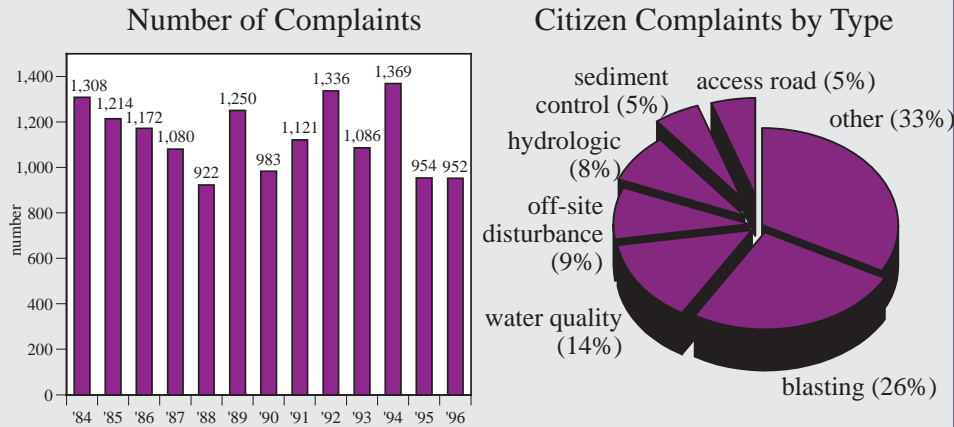
State surface mine officials received 247 blasting and 133 water-related complaints during 1996. On average, about 5% of citizen complaints result in a coal mining operation being cited for a violation, according to DSMRE. Blasting and water complaints often concern damage to private water supplies. The federal surface mine law provides that water supplies damaged by surface mines must be replaced. However, damage to water supplies caused by underground mines was not included in the law. In 1992, the federal law was amended to require all underground coal mining operations to promptly replace certain identified water supplies adversely affected by subsidence from underground coal mining operations. In response to the new federal requirements, the Kentucky General Assembly passed a bill in 1994 requiring replacement of water supplies lost due to underground mining. Between 1994 and Oct. 1997, 330 cases alleging underground coal mining damage to water supplies have been filed under the provisions of the law.

### Coal Mine Bond Forfeitures Continue to Decline

The forfeiture of coal mine permits and bonds due to the failure to properly operate or reclaim a site continues to decline in Kentucky (**Figure 22**). In 1996, \$1.9 million in bonds were forfeited under 91 coal mine permits containing 1,302 acres. This forfeited acreage represents about 2% of the 66,000 acres completely or par-

*A review of the 1,801 violations cited in 1996 at active coal mines in Kentucky reveals that 381, or 22%, were water-related. DSMRE reports that the increase in water violations is due to better enforcement and improved water sampling methods.*

*Most of the coal mine complaints received by DSMRE concern blasting. Kentucky continues to lead the nation in the use of explosives. In 1996, 2.4 million metric tons of explosive were sold in the U.S.—356,000 tons of which were sold in Kentucky.* <sup>26</sup>

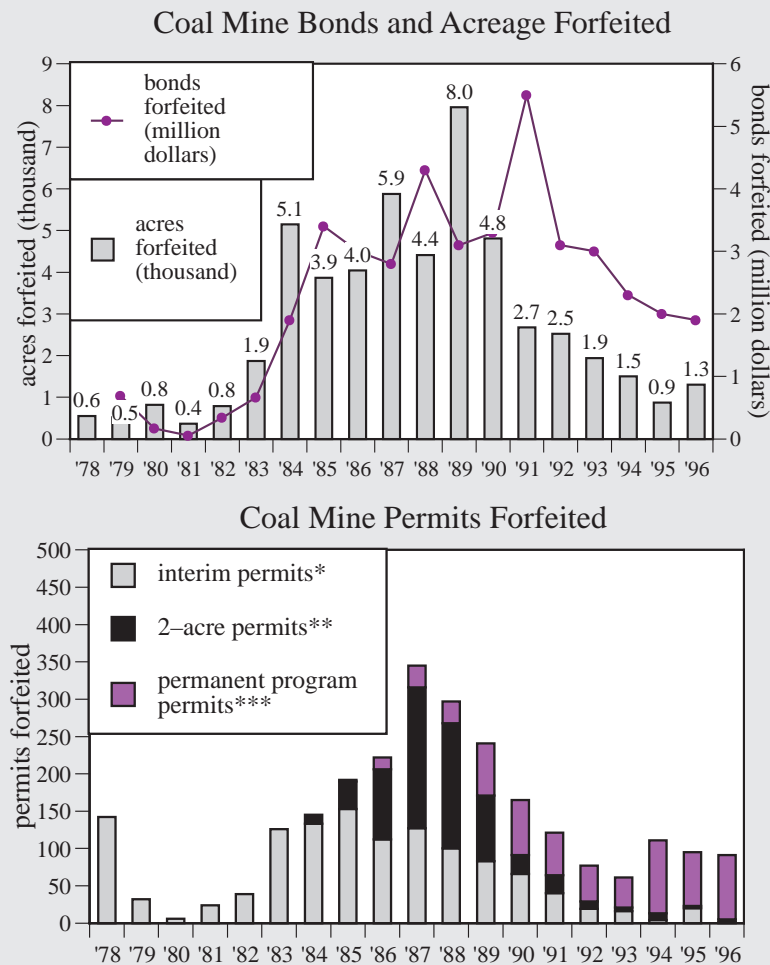
**Figure 20 Citizen Complaints Regarding Coal Mining in Kentucky**

Source: KY Dept. of Surface Mining Reclamation and Enforcement

**Figure 21 Leading States for Explosives Consumption (1996)**

State	metric ton
Kentucky	356
W. Virginia	243
Wyoming	189
Virginia	148
Pennsylvania	142
Indiana	127
Arizona	127
New Mexico	85
Ohio	75
Nevada	73

Source: Institute of Makers of Explosives

**Figure 22 Coal Mine Bond Forfeiture Trends in KY**

\*Interim permits - issued to coal mines in operation from 1978 to 1992. \*\*2-acre permit exemptions - issued to 2-acre mine operations from 1982 to 1987 which exempted operations from performance standards. The 2-acre exemption was repealed in 1987 due to mining abuses. \*\*\*Permanent program permits - cover operations that were active on or that began after 1982.

Source: KY Dept. of Surface Mining Reclamation and Enforcement

tially reclaimed in Kentucky that year.

The \$1.9 million in coal mine bonds forfeited in 1996 was the lowest recorded in the state since 1984. In the past, concerns have been expressed that coal mine bonds were inadequate to reclaim a site. A 1993 study commissioned by the state found that 36% of the 42 mines assessed were considered to have inadequate reclamation bonds. In response, the state created a Supplemental Assurance Fund in 1994 to assure reclamation of sites with approved highwalls in excess of regulatory requirements. Monies posted by the permittee are in addition to and distinct from the reclamation bond required under federal law. Monies are returned to the permittee once rough backfilling and grading have been completed. As of September 1996, DSMRE held \$38.3 million in supplemental assurance funds.

Legislation was also introduced in the 1994 and 1996 Kentucky legislative session to create a bond forfeiture fund financed by interest accrued from forfeited bonds and penalties. The fund would be used to supplement bonds that are inadequate to reclaim a forfeited mine site. The measure failed to pass due to fiscal concerns. DSMRE plans to pursue passage of the legislation in the 1998 session.

## 19,100 Acres of Abandoned Coal Mines Reclaimed, 1,100 Projects Funded Under AML Program Since 1978

The goal of the federal Abandoned Mine Land Reclamation Program is to restore lands mined and abandoned prior to 1982. Kentucky received federal authority to carry out this program in 1982. The national program is supported by a fee of 35 cents per ton of surface mined coal, 15 cents per ton of coal mined underground, and 10 cents per ton of lignite. This money is held in an interest bearing Abandoned Mine Reclamation Fund (AML Fund) by the federal government and allocated back to states and tribes for mine reclamation purposes.

Expenditures from the AML Fund are authorized through the regular congressional budgetary and appropriations process. Federal law specifies that 50% of the AML fees collected be returned to the state of origin for reclamation projects. The remainder of the fees are retained by the federal government to support administrative costs of the program, emergency reclamation projects, and additional discretionary grants to the states based on historical coal extraction.

Since 1978, Kentucky has reclaimed 19,100 acres of abandoned mine lands using AML Funds and more than 1,100 projects have been completed to address abandoned mine land problems (Figure 23). There are an estimated 80,000 to 150,000 acres of abandoned mine lands in Kentucky that are potentially eligible for reclamation.<sup>28</sup> The actual acres of abandoned lands are unknown because they have not been inventoried. This is not a problem unique to Kentucky as most states have not inventoried abandoned mine lands. As such, the full extent abandoned mine lands are contributing to environmental problems in Kentucky is difficult to determine.

### 39% of AML Fees Collected in State Returned to Kentucky

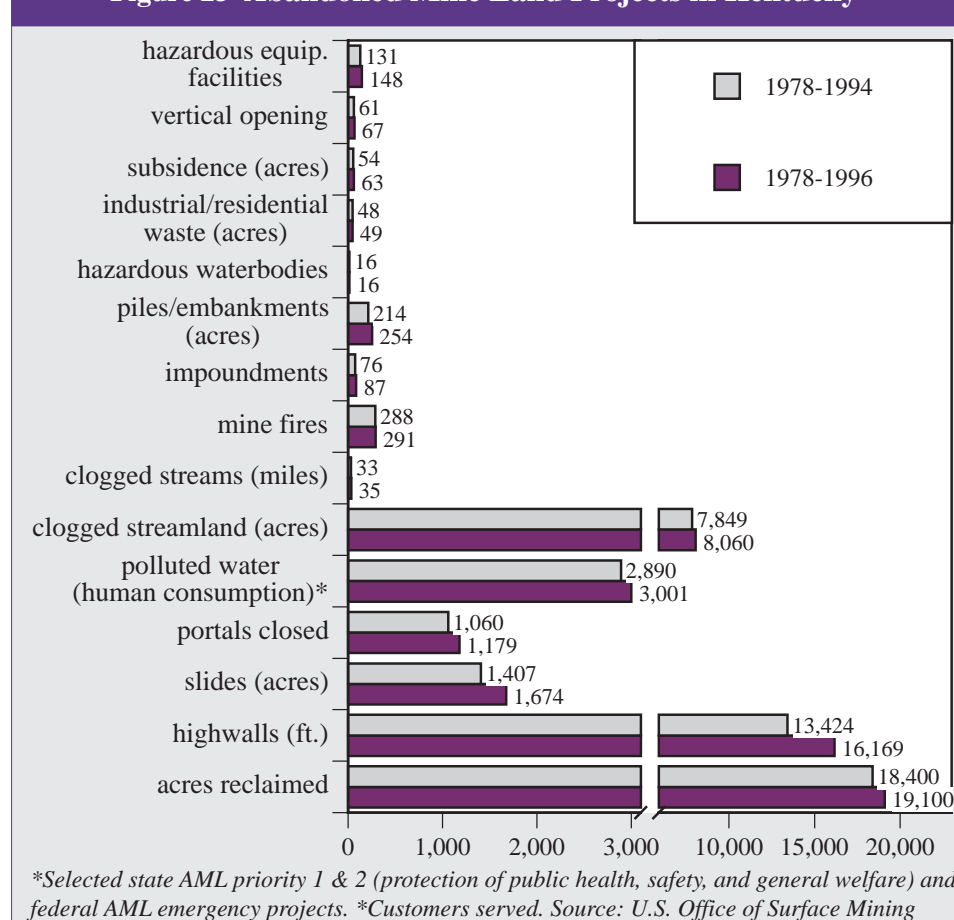
Since 1978, Kentucky has paid \$655.6 million in fees to the AML Fund and received back \$254.8 million in state grants—a 39% return (Figure 24). Consequently, the state's share balance (what is owed to the state and held in trust by Congress) is \$83.6 million. The state also received \$57.8 million in discretionary AML Funds based on historical coal extraction. These discretionary funds are used to supplement state AML grants.

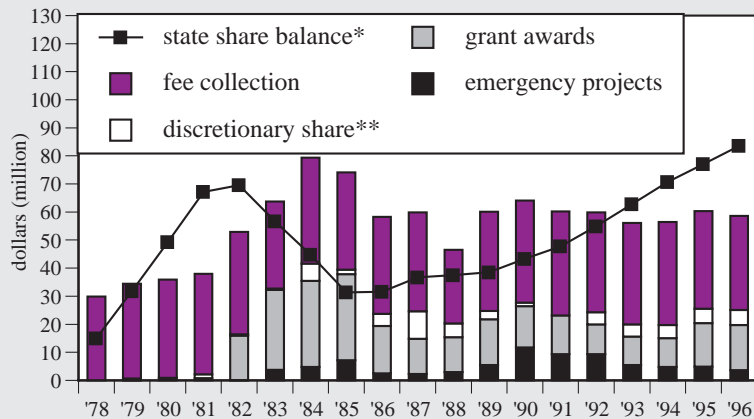
AML projects target those sites that pose an immediate threat to human health. These projects often include stabilizing landslides or the restoration of damaged water supplies. A

*There are an estimated 80,000 to 150,000 acres of abandoned mine lands in Kentucky that are potentially eligible for reclamation.<sup>28</sup> The actual acres of abandoned lands are unknown because they have not been inventoried.*

*AML projects target those sites that pose an immediate threat to human health. These projects often include stabilizing landslides or the restoration of damaged drinking water supplies.*

**Figure 23 Abandoned Mine Land Projects in Kentucky\***



**Figure 24 Abandoned Mine Land Funding in KY**

\*Cumulative balance of fees collected and not returned to Kentucky as specified under federal AML law. \*\*Additional AML Funds based on historical coal extraction. Source: KY Dept. of Surface Mining Reclamation and Enforcement

**Figure 25 AML Fund Disbursement - 13th Annual Grant for Kentucky****Receipts**

■ AML Grants\* \$16,384,125

**Expenditures**

■ Program Adm. \$ 2,402,225

■ Project costs \$13,981,900

projects funded	units
clogged stream	0.2 miles
clogged stream land	7 acres
7 water lines	50 miles/932 meters**
impoundments	2
portals closed	14
highwalls	900 feet
slides	40 acres
subsidence	0.3 acres
vertical openings	2
piles/embankments	18.4 acres
haz. equip & facilities	10
hazardous waterbody	2

Note: Based on 13th annual grant receive in 1994 and obligated over a 3-year period. Grant closed out in 1997.

\*Includes AML grant awards and discretionary AML Funds. \*\*Customers served. Source: KY Dept. of Surface Mining Reclamation and Enforcement

A review of the disbursement of \$16.3 million Kentucky received from the AML Fund in 1994 reveals that \$2.4 million was used for administrative costs and \$13.9 million financed 31 projects.

review of the disbursement of \$16.3 million received by Kentucky from the AML Fund in 1994 reveals that \$2.4 million was used for administrative costs (agency salaries, rent, and equipment). The remaining \$13.9 million financed 31 projects (Figure 25).

Since 1979, the federal government has also expended \$84 million in AML Funds to finance 621 emergency projects in the state.<sup>29</sup> A review of funding for OSM emergency projects in Kentucky, however, reveals a steady decline—from \$11.8 million in 1990 to \$3.7 million in 1996. This decline is due to a cap set by Congress in 1992. The cap limits federal emergency spending

in Kentucky to about \$4.5 million per year. The limited funding has resulted in the referral of remaining reclamation work by OSM to the state after the completion of minimum reclamation on federal emergency projects.<sup>30</sup>

Many people charge that the AML Fund monies are being held to help offset the federal deficit.<sup>31</sup> As of March 31, 1997 a total of \$4.6 billion had been collected and deposited into the AML Fund of which \$3.5 billion has been appropriated—leaving a balance of \$1.1 billion. Since 1992, Congress also directed the fund be used for United Mine Workers of America pension benefits owed due to bankrupt union coal companies. During 1996, \$47 million was appropriated from the AML Fund for this purpose. National interests such as the Citizens Coal Council and the United Mine Workers as well as the Kentucky Coal Association, Kentuckians for the Commonwealth, and state officials continue to call upon Congress to release the \$1.1 billion balance of the AML Fund to help clean up old mine sites. The Citizens Coal Council reports that \$4.2 billion is still needed to fund those sites where no or only partial reclamation has been done—\$394.7 million of which is needed in Kentucky.<sup>32</sup> Kentucky officials indicate that the financial need is much greater in the state since this figure represents only inventoried sites and many new sites are discovered every year.

**Acid Mine Drainage Impacting 52 Streams**

Acid mine drainage is caused by water passing over or through mines, spoils, and refuse piles where it becomes acidic and/or laden with metals such as iron, manganese, and aluminum. Acid mine drainage can impact the pH of a stream and cause serious environmental damage as well as add to the cost of treating water used for public water supplies. Acid mine drainage can coat stream beds with iron resulting in reddish-orange or yellow stains. The Division of Water lists 52 streams that are impaired by acid mine drainage (Figure 26).

Little has been done in the past decade to assess and address the impact of acid mine drainage in Kentucky and other coal mining states. In response, the Appala-

chian Clean Streams Initiative (ACSI) was created in 1994 by the U.S. Department of Interior to encourage cooperative efforts to eliminate acid mine drainage from abandoned mine lands. Fifteen states, including Kentucky, are participating in the ACSI. The Initiative uses both public and private funds to finance cooperative restoration projects. Kentucky has two ACSI projects underway:

■ East Diamond Tipple, Hopkins County - 150-acre refuse and slurry site polluting Flat Creek. ACSI will provide Andalex Resources \$100,000 of the \$535,000 earmarked for the completion of this remining project.

■ Brier Creek, Muhlenberg County - 100-acre site where erosion and failure of a sediment pond have filled 2,500 feet of Brier Creek. The cost of the project is \$700,000 with ACSI providing \$225,000.

Two more projects have been proposed by the state:

■ Spewing Camp Branch, Floyd County - 86-acre site impacting Spewing Camp Branch.

■ Ketchup Lake, Hopkins County - 280-acre site impacting Greasy Creek.

### State Issues Seven Permits to Remine and Reclaim Abandoned Mine Lands

Abandoned mine lands are contributing to environmental problems in Kentucky. However, many of these sites have not been remediated due to a lack of resources. In an effort to clean up abandoned mine lands, Kentucky has begun issuing permits to allow coal mining companies to remine old sites by providing alternative effluent standards for remining operations.

During 1996, seven remining permits were issued: Black Diamond, Webster County (340 acres); Beech Creek, Muhlenberg County (105 acres); Warrior Coal Company, Hopkins County (233 acres); Andalex Resources Pleasant View, Hopkins County (5 acres); Peabody Coal Company, Ohio County (40 acres); Ison Coal Company, Letcher County (400 acres); and Andalex Resources East Diamond Tipple, Hopkins County (150 acres). Five more remining permits are pending in Bell, Clay, Letcher, and Pike counties.

The Andalex Coal Company's East Diamond complex near Madisonville is an example of how remining may improve environmental quality while saving taxpayers money. Polluted runoff from this abandoned 150-acre site has polluted Flat Creek, which subsequently flows through the White City Wildlife Area. Andalex Coal Company activated a permit to remine this area after signing a Memorandum of Agreement in August 1997 with DSMRE and OSM. The company hopes to recover 300,000 tons of coal as it removes 3 million cubic yards of acid refuse and slurry from the site. The company also plans to extract 1.5 million tons of coal underground over a three-year period. If the state and federal government were to pay to reclaim this site, it would cost more than \$4 million. Instead, Andalex will remine and reclaim the area using \$435,000 of AML money and \$100,000 of ACSI funds.

**Figure 26 KY Waterways Impaired by Acid Mine Drainage\***

County/ waterway	miles	County/ waterway	miles
<b>Bell</b>		<b>McCreary</b>	
Turkey Creek	2.7	White Oak Cr.	4.2
LF Straight Cr.	1.3	Rock Creek	4.1
<b>Butler</b>		Ryans Creek	5.3
Little Reedy	12.0	Lick Creek	5.7
<b>Daviess</b>		Barren Fork	5.3
Render Creek	6.1	Bear Creek	3.2
<b>Edmonson</b>		Bucks Branch	2.0
Dismal Creek	2.3	Cane Creek	2.0
<b>Floyd</b>		Copperas Cr.	3.8
LF Middle Cr.	5.3	Crummies Cr.	6.4
Buck Branch	0.7	Devils Cr.	2.4
<b>Harlan</b>		<b>McLean</b>	
Martins Fork	10.0	Cypress Cr.	10.4
<b>Hopkins</b>		<b>Ohio</b>	
Cane Creek	3.4	Williams Cr.	5.3
Caney Creek	11.3	Issacs Creek	5.8
Fox Run	2.1	Flat Creek	10.6
Lambs Creek	4.9	<b>Muhlenberg</b>	
Lick Creek	18.1	Thompson Cr.	6.0
Pond Creek	4.6	Nelson Creek	4.3
Sugar Creek	5.3	Little Hazel Cr.	3.9
Pond Creek	30.1	L. Cypress Cr.	10.4
Pleasant Run	7.9	Harris Branch	2.6
Crab Orchard	7.6	Beech Creek	3.4
<b>Jackson</b>		Brier Creek	4.7
Indian Creek	4.0	Caney Creek	7.0
<b>Knott</b>		<b>Perry</b>	
Clear Creek	5.5	Leatherwood C	20.5
<b>Laurel</b>		<b>Pike</b>	
Little Raccoon	7.7	Lick Fork	2.0
<b>Letcher</b>		Long Fork	5.1
Rockhouse Cr.	24.3	Stinking Creek	2.3
<i>*Based on assessed</i>		Hurricane Cr.	2.4
<i>waterways. Source: KY Div.</i>		<b>Pulaski</b>	
<i>of Water, 1996 Report to</i>		Wildcat Branch	2.1
<i>Congress on Water Quality</i>		Lacy Fork	1.0
<i>as updated by Division of</i>		<b>total</b>	<b>331.4</b>
<i>Water 10/22/97.</i>			

# Oil and Natural Gas

*The U.S. is the world's greatest consumer of petroleum—consuming two to three times more than any other country.<sup>33</sup> In Kentucky, the consumption of petroleum for transportation alone rose 188% between 1960 and 1994.*

Kentucky and the nation consume large amounts of petroleum and natural gas to meet our energy needs. In fact, the U.S. is the world's greatest consumer of petroleum—consuming two to three times more than any other country.<sup>33</sup> In Kentucky, the consumption of petroleum for transportation alone rose 188% between 1960 and 1994 (**Figure 27**). This trend reflects the increased mobility of Kentucky's growing population as well as expansion of airports and increased airline traffic.

Kentucky has produced oil and natural gas since the early to mid 1800s. An estimated 170,000 oil and gas wells have been drilled in the state, according to Kentucky Geological Survey records. The following indicators measure oil and gas production and consumption trends in the state as well as efforts to address environmental problems caused by drilling activities.

## Oil Production Continues to Decline; Gas Production Remains Steady

More than half of the petroleum consumed in the U.S. is imported. **Figure 28** reveals that daily U.S. crude oil production of six million barrels in 1996 falls well short of the 18 million barrels of refined petroleum products consumed each day. Kentucky's and the nation's consumption of finished petroleum products

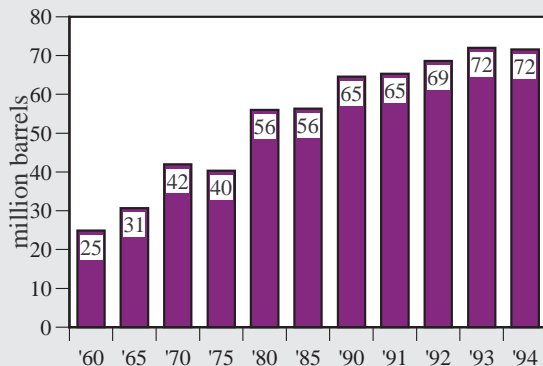
continues to increase. For example, between 1986 and 1996, U.S. petroleum use rose by 12% while Kentucky use increased by 25% (**Figure 28**).

Kentucky ranks 20th among 31 states with oil production.<sup>34</sup> The state produced 3.6 million barrels in 1996, about 0.15% of the 2.3 billion barrels produced in the U.S. that year. Oil production occurs in 53 counties. During 1996 49% of oil production occurred in West Kentucky (**Figure 29**). Crude oil production levels have been steadily declining in the state, dropping from 17,704 barrels a day in 1986 to 9,424 barrels a day in 1996. This decline is attributed to the low and variable price of crude oil on the world market.

Kentucky ranks 17th among 33 states with natural gas production.<sup>35</sup> In 1996, the state produced 83 billion cubic feet; 0.34% of the nation's 24 trillion cubic feet of gas (**Figure 30**).

Growth in natural gas production has been fueled by rising market prices and increased demand which is attributed to the cleaner burning characteristics of natural gas. There are 24 active natural gas fields covering 29 counties. Nearly all natural gas production, about 99%, occurs in the eastern part of the state (**Figure 31**).

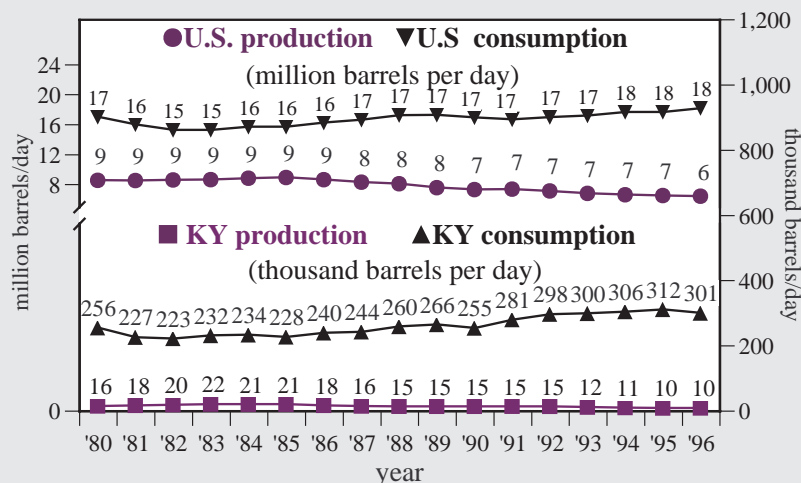
**Figure 27 Consumption of Petroleum for Transportation in Kentucky**



Note: 1994 data most recent.

Source: U.S. Energy Information Adm.

**Figure 28 Oil Production/Consumption in U.S. and KY**



\*Crude oil production. \*\*Refined petroleum products consumed. Totals rounded.

Source: U.S. Energy Information Administration

## 88,313 Oil and Gas Permits Issued Since 1960

In 1960, the Department of Mines and Minerals, Division of Oil and Gas (DO&G) was established to foster conservation, exploration, protect

the rights of land and mineral owners, and regulate construction/operation of oil and gas wells. Between 1948 and 1960 the Department of Mines and Minerals required operators of oil and gas wells in coal regions to register with the agency.

DO&G began permitting oil and gas wells in 1960. Since then, 88,313 oil and gas permits have been issued of which 46,500 are currently productive wells. The total number of oil and gas permits issued each year continues to decline (Figure 32). For example, permits fell from 1,169 in 1992 to 756 in 1996, primarily due to reduced oil production.

During 1996, DO&G's 16 inspectors conducted more than 3,000 inspections at oil and gas operations (Figure 33). At least four inspections are conducted during the life of a well to ensure proper construction, operation, and plugging. DO&G officials note that the increase in inspections during 1993 was likely the result of an oil boom in Clinton County that year after the discovery of a new oil field (Figure 34). And the increase in inspections during 1995 was the result of state legislation passed in 1994 requiring three additional inspections per well site where there is a severance of the mineral and surface ownership.

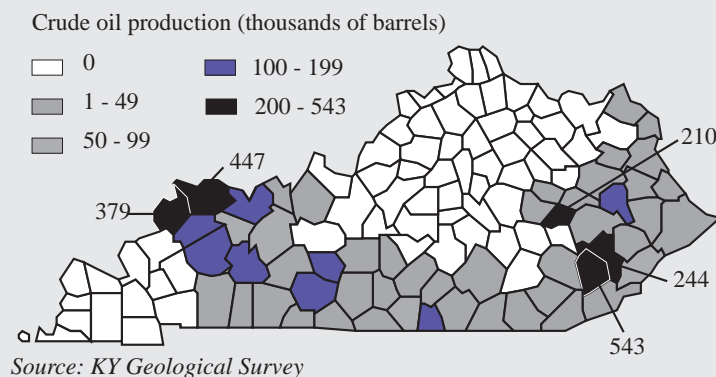
DO&G also responds to citizen complaints. Since 1993, when a more formal complaints system was developed, complaints have averaged about 69 per year (Figure 33). DO&G reports that they receive few complaints. Only 66 complaints were received in 1996; a low number considering there were 46,500 producing oil and gas wells. Most complaints concern abandoned wells, groundwater, or dust.

### Violations at Oil and Gas Wells Double Between 1995 and 1996

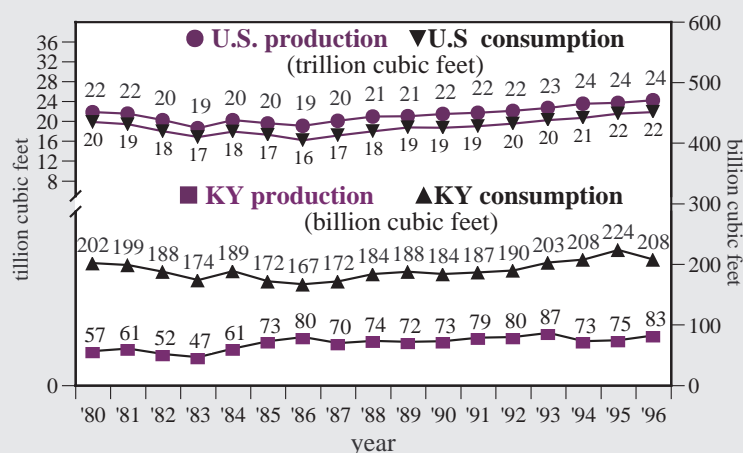
During 1996, 957 violations were cited at oil and gas wells by DO&G inspectors (Figure 33). Between 1995 and 1996 violations nearly doubled from 532 to 957. DO&G officials believe the increase in violations may be due to an improved computer system to track oil and gas operations.

A closer look at violations reveals that 56% were for improper plugging while 14% were for operating without proper bonding (Figure 35). The greatest number of the violations cited in 1996 occurred in Clay County (171 violations), followed by Ohio County (43 violations), Christian County (37 violations), Edmonson County (35 violations), Clinton County (34 violations), and Floyd County (29 violations).

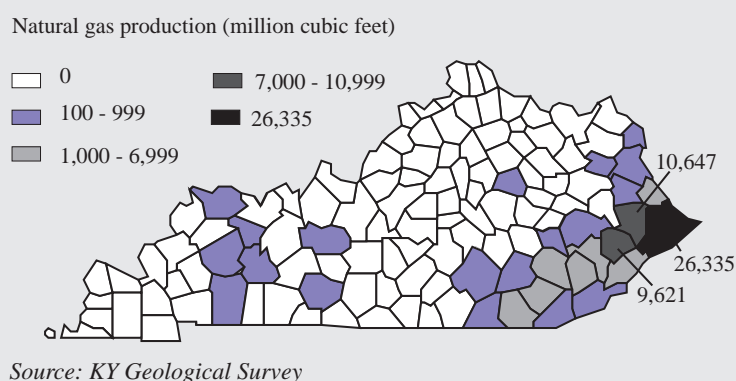
**Figure 29 Crude Oil Production in KY (1995)**

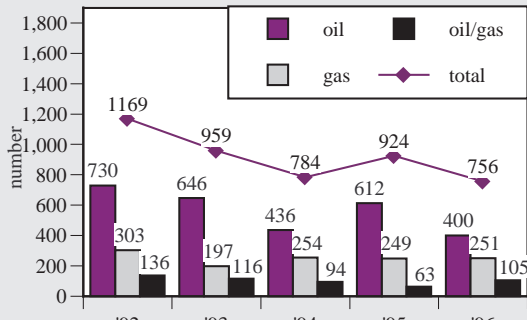


**Figure 30 Natural Gas Production/Consumption in U.S. and Kentucky**

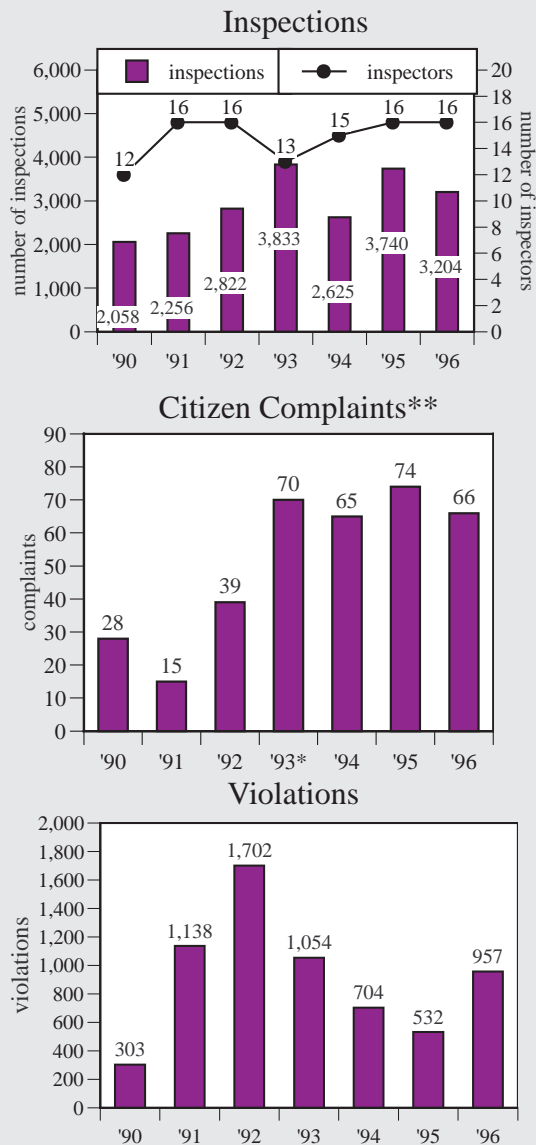


**Figure 31 Natural Gas Production (1995)**



**Figure 32 Oil and Gas Permits\***

\*As issued by Div. of Oil and Gas. Data prior to 1992 not available. Source: KY Dept. of Mines and Minerals

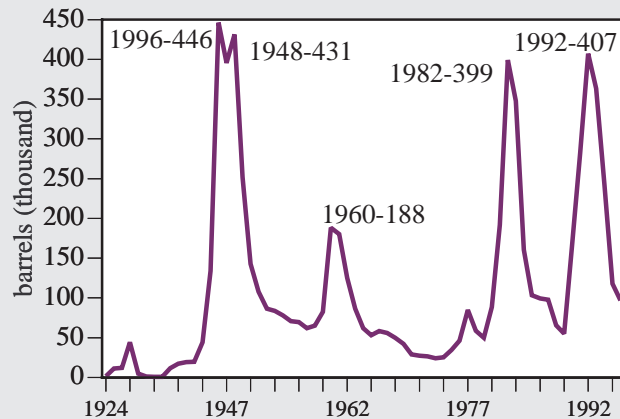
**Figure 33 Oil and Gas Compliance: Operation and Closure of Wells\***

\*As cited by Div. of Oil and Gas. \*\*Formal interoffice complaints form developed by the Div. of Oil and Gas in 1993. Source: KY Dept. of Mines and Minerals

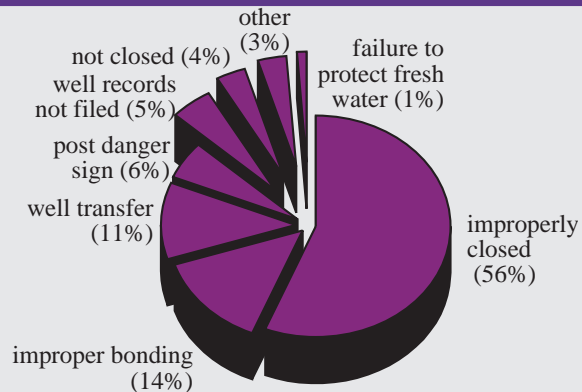
## Pollution From Oil Wells Impacting 70 Miles of Assessed Waterways in Kentucky

DO&G reports that most environmental problems occur at older oil wells and small independently-owned wells. Pollution from oil and gas wells can be caused by oil, grease, and brines associated with production. Brine, which can contain more salt than sea water, is currently impairing water quality in five river basins (**Figure 36**). Oil and gas operations are causing 2% of the known water pollution problems in Kentucky; polluting 70 miles of assessed waterways in the state (**Figure 37**).

Water discharges from drilling operations and related production facilities are regulated by the U.S. Environmental Protection Agency (EPA) and the Kentucky Division of Water. The state established a water quality chloride standard of 600/1000 (chronic/acute) milligrams per liter in 1985 to control brine discharges. The Division of Water currently regulates brine and associated oil and gas discharges to waterways through 25 KPDES permits. Most oil and gas operations are not required to have a KPDES permit. During 1996, 7,120 inspections were conducted at oil and gas wells and 82 water quality violations were cited that year (**Figure 38**).

**Figure 34 Oil Booms in Clinton County, KY**

Source: KY Geological Survey

**Figure 35 Oil and Gas Violations Types (1996)**

\*Based on 957 violations cited by Div. of Oil and Gas. Source: KY Dept. of Mines and Minerals

**Figure 36 Chloride Pollution in Assessed Streams in KY By Basin**

River Basin	Miles not supporting uses				
	1987*	1989*	1991	1993	1995
Licking River	13	36	37	32	0
Kentucky River	60	83	44	84	15.1
Big Sandy	66	34	0	9	13.5
Little Sandy	31	12	12	12	12
Green River	0	52	18	0	0.6
Upper Cumberland	21	59	3	0	2.6
<b>Total</b>	<b>191</b>	<b>276</b>	<b>114</b>	<b>137</b>	<b>43.7</b>

*\*Includes monitored and assessed waterways partially supporting and not supporting designated uses. Source: KY Div. of Water, Reports to Congress on Water Quality*

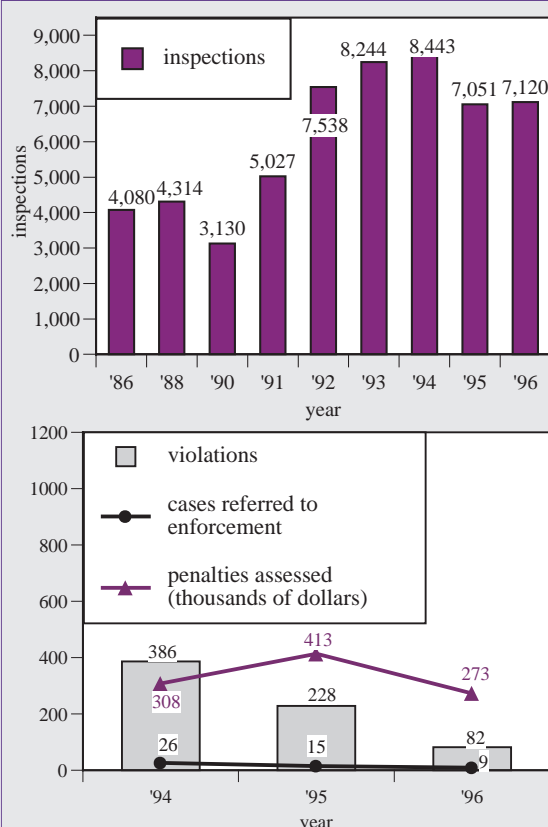
Division of Water officials report that a strong enforcement presence combined with better industry compliance and a decline in oil production have reduced violations and the level of chlorides in several waterways. A water quality analysis conducted by the Division of Water in 1994 found chloride levels decreased significantly at 19 stream monitoring stations and increased at two.<sup>36</sup>

The U.S. EPA issues Underground Injection Control (UIC) permits to regulate the injection of fluids and disposal of brine at 2,066 wells in Kentucky (Figure 39). During 1996, 59 enforcement actions were taken against operators for failure to comply with UIC rules.

## 102 Oil and Gas Bonds Forfeited in 1996, 213 Released

Because the state does not have the authority to assess fines against violators of oil and gas rules, it must rely on bond forfeitures as its primary enforcement tool. Figure 40 reveals that 102 bonds were forfeited in 1996, the lowest number since 1991 when EQC began to report on oil and gas bond forfeitures.

DO&G attributes the recent decline in bond forfeitures to market pressures which have forced many marginal operators out of business. Once an operator has forfeited a bond, it is up to DO&G to determine whether that operator will be granted a new permit. In most cases, DO&G does not grant blanket bonds for multiple wells to operators who have forfeited a bond but will consider issuing individual permits. The agency has not compiled information on how many operators who have forfeited bonds have subsequently received new permits.

**Figure 38 Oil and Gas Compliance: Water Quality Inspections/Violations\***

*\*Inspections conducted and violations cited by the Division of Water Field Operations Branch. Earlier data not available. Source: KY Division of Water*

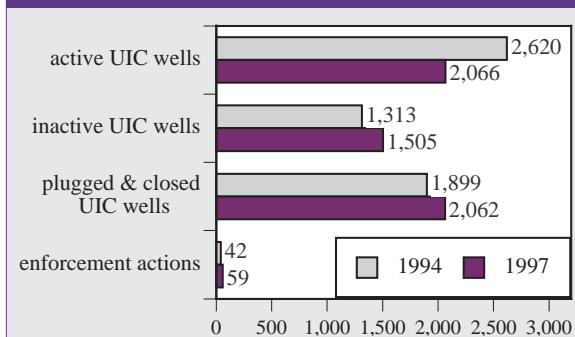
**Figure 37 Streams Impaired by Oil and Gas Pollution\***

County/ waterway	miles
<b>Clinton</b>	
Spring Cr.	3.6
<b>Elliott</b>	
Newcombe Cr.	11.9
<b>Green</b>	
SF Russell Cr.	0.6
<b>Laurel</b>	
Robinson Cr.	4.1
<b>Lawrence</b>	
RF Blaine Cr.	6.2
<b>Leslie</b>	
Cushin Cr.	28.8
<b>Powell</b>	
Sand Lick Fk.	5.0
SF Red River	10.1

*\*Includes monitored and assessed waterways partially supporting and not supporting designated uses. Source: KY Div. of Water, 1996 Report to Congress on Water Quality*

*Oil and gas operations are causing 2% of the known water pollution problems in Kentucky; polluting 70 miles of assessed waterways in the state.*

*Division of Water officials report that a stronger enforcement presence combined with better industry compliance and a decline in oil production have reduced violations cited at oil and gas operations and the level of chlorides in several waterways.*

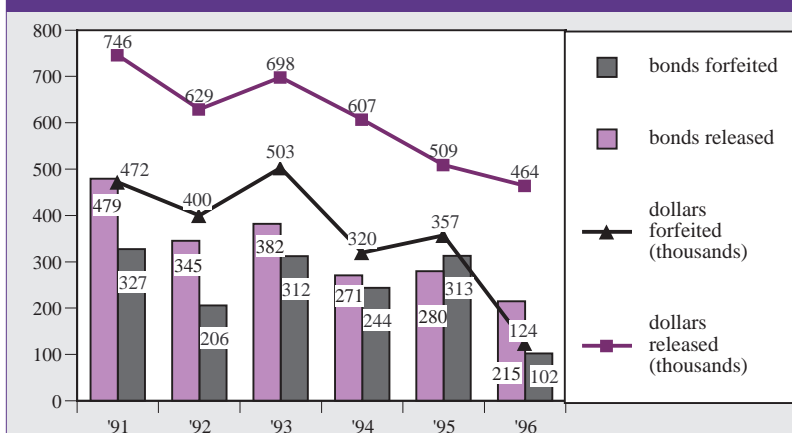
**Figure 39 Oil and Gas UIC Wells in KY**

Note: Underground Injection Control wells used to inject produced brine by oil and gas wells. Source: U.S. EPA

Oil and gas bond forfeiture rates still remain high in Kentucky. In 1996, for example, 213 bonds were released while 103 were forfeited. Bond amounts were increased in 1994 and now range from \$500 for an individual well to \$10,000 for multiple wells (based on well depth). However, DO&G officials indicate that bond amounts still do not cover the complete cost of plugging and reclaiming a well site.

### 11,595 Abandoned Wells in Kentucky; 1,162 Plugged

According to the Interstate Oil and Gas Compact Commission, there are an estimated 285,000 idle wells in the U.S.<sup>37</sup> About 5% are abandoned. Kentucky has an estimated 11,595 abandoned wells.

**Figure 40 Oil and Gas Bond Forfeitures /Releases in KY**

Source: KY Dept. of Mines and Minerals

Abandoned oil and gas wells are plugged using interest accrued from bonds and bond forfeitures. The money generally raises \$400,000 a year—enough money to plug about 200 wells. As of 1996, DO&G had plugged 1,162 abandoned oil and gas wells (Figure 41). During 1996, 212 wells were plugged by DO&G, well above the 90 plugged in 1995 and 88 plugged in 1994. Abandoned wells are prioritized and plugged based on potential hazards to the environment.

### Efforts Underway to Cleanup Radioactive Materials From Oil Fields

Another environmental threat posed by

*Because the state does not have the authority to assess fines against violators of oil and gas rules, it must rely on bond forfeitures as its primary enforcement tool. Division of Oil and Gas officials attribute the recent decline in bond forfeitures to market pressures which forced many marginal operators out of business.*

certain oil wells is naturally occurring radioactive materials (NORM). Naturally occurring radionuclides are pervasive in the materials that make up the earth. Certain rock and soil formations have higher concentrations of NORM. Products made from or fluids in contact with these materials naturally include part of their inherent radioactivity. In the case of oil drilling, NORM is brought to the surface through the forced injection of water into a well to increase the level of recoverable oil or through naturally produced water. Generally, it takes years for NORM to become concentrated or “technically enhanced” in oil pits and at tank batteries.

NORM was discovered in Kentucky in 1988 in the Martha Oil Fields in Lawrence and Johnson counties. While the state does have regulations governing the handling and disposal of radioactive materials in Kentucky, presently, there are no regulations that specifically address the cleanup, storage, and disposal of NORM. Remediation and storage standards were drafted by the Kentucky Cabinet for Health Services (CHS) in 1994 but have not been finalized.

In 1995, CHS negotiated an agreement with Ashland Exploration Inc. to remediate certain NORM-impacted areas of the Martha Oil Field. Remediation levels of 5 pCi/g were established by CHS.<sup>38</sup> Since the agreement, some 90,000 tons of NORM contaminated soil with an average concentration of 16 pCi/g has been excavated from 200 well sites and stored in temporary facility at the Johnson-Lawrence County border. In 1996, Ashland proposed disposing the waste in the Blue Ridge Landfill in Estill County. Estill County community leaders opposed the proposal and filed a lawsuit in June to stop Waste Management Inc., the owner of the landfill, from seeking a permit to accept the waste. The suit asked for

legal interpretation of a host agreement between Estill County and Waste Management Inc. The suit charges that NORM is a toxic waste and is prohibited by the agreement. In late August, local government and landfill officials entered into an agreement to ban the disposal of NORM at the landfill. Waste Management subsequently withdrew its permit application.

It is not known how extensive a problem NORM is in Kentucky and more studies are needed to assess its impacts on the environment and public health. According to CHS, Kentucky also needs to promulgate regulations for the remediation of NORM-impacted areas and conditions for storage. The position of CHS has been to delay action on the regulations until the remediation of the Martha Oil Field is complete.<sup>39</sup>

## State Passes Measures to Address Oil and Gas Disputes

In many cases, the owners of the oil and gas reserves do not own the surface rights. Landowner concerns about the impact of oil and gas operations to land and water led to the passage of two laws in the 1994 General Assembly.

One of the measures focused on resolving disputes between well drillers and surface landowners. The bill provides that where there is a complete severance of the ownership of the oil and gas from the ownership of the surface to be disturbed, the oil and gas operator must:

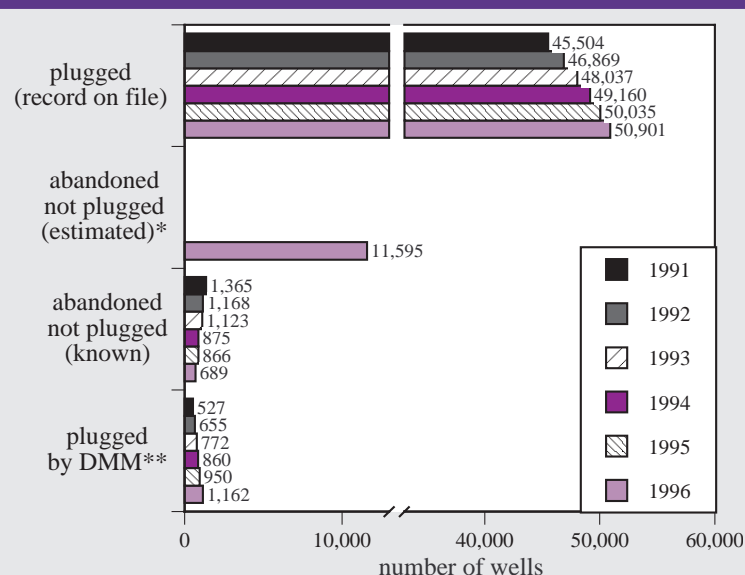
- Submit a plan to the Department of Mines and Minerals to prevent erosion.
  - Provide a description of the location of all areas to be disturbed including roads, well sites, tanks, and other storage facilities.
  - Provide an agreement by the surface owner to the operation/reclamation plan.
- Between July 1994 and July 1997, 366 severed mineral permits have been issued by the Department of Mines and Minerals. To date, 30 of the 366 agreements have been unsigned by landowners, 10 of which have gone to mediation.

The other law passed in 1994 requires oil and gas operators to remediate or compensate owners for damage caused to surface and groundwater. It is up to the landowner to prove the water supply was damaged or impaired by an oil or gas operation. Neither the Department of Mines and Minerals nor the Division of Water monitor the number of water damage claims filed pursuant to this law so the effect of the law cannot be readily determined.

## References

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- 2.KY Cabinet for Economic Development; 1997 KY Deskbook of Economic Statistics.
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**Figure 41 Number of Plugged and Abandoned Oil and Gas Wells in Kentucky**



\*Earlier data provided by Div. of Oil & Gas that appeared in previous State of Kentucky's Environment reports now considered inaccurate.

\*\*Cumulative total of oil and gas wells plugged by Div. of Oil & Gas.

Source: KY Dept. of Mines and Minerals

Kentucky has an estimated 11,595 abandoned oil and gas wells. Abandoned wells are plugged using interest accrued from bonds and bond forfeitures. The money generally raises \$400,000 a year—enough money to plug about 200 wells.

During 1996, 212 wells were plugged by the Division of Oil and Gas, well above the 90 plugged in 1995 and 88 plugged in 1994. Abandoned wells are prioritized and plugged based on potential hazards to the environment.

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